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TELEVISION VIDEO DETECTORS*

Analysis of Signal Polarity, Diode Detection, Frequency Response, D-C Coupling and Typical Detector Circuits

The video detector removes the picture modulation from the picture i-f carrier. This modulation consists of picture, sync and blanking and is in the form of the composite television signal formed at the transmitter. The composite signal, of course, is a single polarity signal and the diode detector must be connected to develop a signal of the proper polarity for utilization at the picture tube. The video detector must be designed to detect the highest frequency component of modulation and at the same time reject the lowest frequency component of the i-f spectrum.

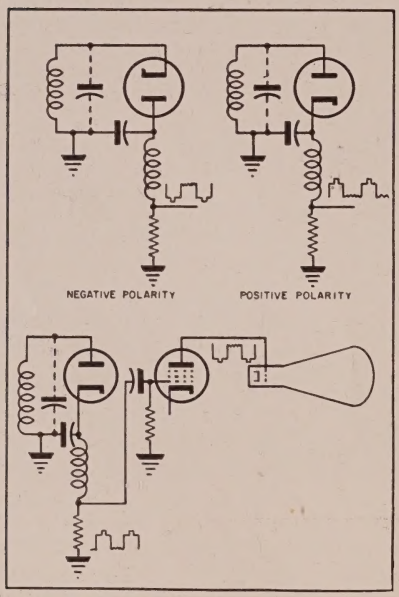

Fig. 1. Relation of detector and picture-tube signal polarities.

Signal Polarity

It is necessary that we have a negative-going composite signal applied to the grid of the picture tube. Thus the darkest portion of the televised scene and the blanking level of this signal occurs at a point where the instantaneous grid voltage is far enough negative to cause the picture to be dark or to be cut off. During the brighter portion of the scene there is less negative voltage applied to the grid of the picture tube and the screen is illuminated.

Since the detected output of the video detector is the composite television signal, the polarity of the diode detector output must be such that the polarity of the composite signal, when it reaches the control grid of the picture tube, is negative. If there are an even number of video stages between the detector and grid of the picture tube, the detector output must be negative; for an odd number of stages, positive. If the signal is applied to the cathode of the picture tube, as in a new G. E. receiver, a positive signal must be applied to the cathode of the picture tube. This necessitates a positive detected signal when an even number of stages are used and a negative signal

* *By Edward M. Noll in "Service."*

when an odd number of stages are used. Two typical detectors, one of each polarity, are shown in Fig. 1. When the plate of the diode is connected above i-f signal ground a positive polarity signal develops across the

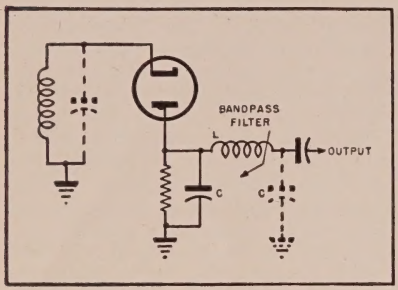

Fig. 2. Bandpass filter used in the output of a video detector.

diode load resistor. When the cathode is above i-f signal ground a negative signal appears across the diode load resistor. The latter is the preferred connection because the tube capacity shunted across the output diode load resistor (plate to ground capacity) is less.

Frequency Response

It is an inherent characteristic of the diode detector to develop a stronger signal at the middle range of frequency than at the higher frequency ranges because of the degenerative effects of shunt capacity across the diode-load resistor. For detection of a-f alone, this defect is not serious, the size of a typical diode-load resistor varying from .5 to 5 megohms. However, in television where we detect video frequencies as high as four megacycles it is necessary to drastically lower the size of the diode load resistor to prevent degeneration at these frequencies in comparison to the middle range of frequencies. Thus the decreasing reactance of the distributed capacity at high frequencies does not reduce seriously the value of the output load resistance.

Typical video diode load resistors vary from 2,000 to 5,000 ohms. The efficiency of the diode detector is seriously reduced when the value of the diode load resistor is decreased to such a low value. Consequently, the amplitude of the developed signal is much lower and it is necessary that the i-f amplifier have a much higher gain than the i-f system used in broadcast receiver service. It is apparent therefore, that a multi-tube i-f system is necessary for picture reception, not only because of the bandwidth of the i-f bandpass required but because of the need for a much higher amplitude signal as applied to the video detector.

It is not only necessary for the video detector to detect the high-frequency components of modulation up to 4 mc, but the detector output circuit must also filter the i-f frequencies. Inasmuch as the lowest frequency i-f component is not very much higher in frequency than the highest frequency

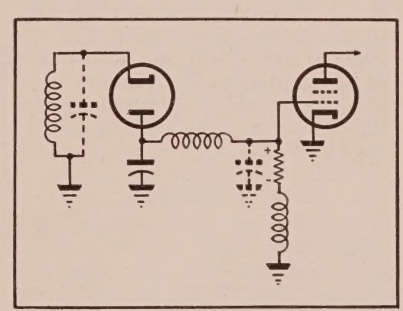

Fig. 3. A typical d-c coupled video-detector stage.

component of modulation, it is necessary to use a bandpass filter which passes the high frequency component of modulation, but has sufficient attenuation to remove the lower frequency components of the i-f frequency

spectrum. Such a bandpass output circuit is shown in Fig. 2. It will be noted that the filter is a simple low-pass filter, which passes components of frequency up to 4 mc, but after that point begins to reject frequencies and causes

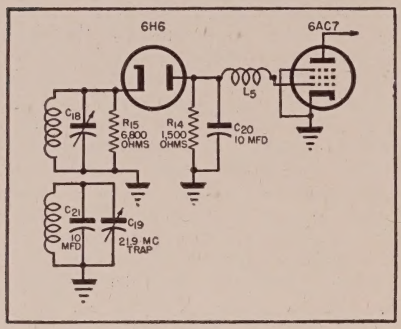

Fig. 4. The direct-coupled video detector used in the G.E. 801.

all of the i-f components to be filtered out. In the case of the prewar television receivers, this bandpass filter had to be critically designed because the lowest frequency component of i-f signal was at approximately 8.5 mc, which is only double the highest frequency component of modulation at 4 mc. With the new i-f frequencies in the 25-mc range this bandpass filter is not as critical.

D-C Coupling

In many television receivers the output of the video detector is direct coupled to the first video amplifier. Inasmuch as the output of the detector is a single polarity signal, this d-c component of signal is not lost when the signal is direct coupled to the succeeding video amplifier, instead of coupling through a capacitor which will change the d-c level as the average brightness varies. A typical d-c coupled stage is shown in Fig. 3. In this circuit the grid of the video amplifier is connected directly to the top of the diode load resistor. Consequently the no-signal current, which flows through the diode resistor because of contact potential, sets the no-signal bias of the grid of the video amplifier. This bias is, of course, negative. When signal is applied to the video detector the output of the diode load resistor swings negative in accordance with the instantaneous amplitude of the i-f signal. The darker the scene transmitted, the further negative is the voltage across this diode resistor and, consequently, the further negative the grid of the first video amplifier is driven. However, the applied signal can only make the output signal swing negative and consequently the grid signal will only swing negative with respect to its d-c component of bias. This constitutes direct coupling to the video amplifier.

It will be noted in the circuit that a coil is connected between the low side of the diode resistor and ground. This inductor is a shunt-peaking coil and boosts the output impedance of the diode circuit at high frequencies. Actually it forms a partially resonant circuit with the distributed circuit

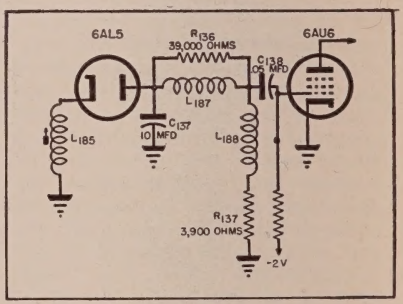

Fig. 5. The RCA 630TS video detector.

capacity, which counteracts the decreasing reactance of the shunt capacity, which is so effective in degenerating the high frequencies. Thus, most diode detectors in addition to the series bandpass filter inductor, also employ

the shunt peak coil to further boost the high-frequency components of modulation.

Typical Video Detector

A typical direct-coupled negative polarity video detector appears in Fig. 4, G. E. 801. The i-f signal is applied between cathode and ground on the detector and develops a negative polarity signal across resistor, R_{14}, a 1,500-ohm diode load resistor. The bandpass filter of the detector consists of capacitor C_{20}, inductor L_5, and the input capacity of the video amplifier. The grid bias on the video amplifier is represented by the very small voltage drop across R_{14}, caused by the static diode current.

Resistor R_{15} is the load for the video detector tuned circuit. A proximity trap tuned to 21.9 mc removes any trace of sound from the picture i-f signal.

RCA 630TS Detector

The video detector of the RCA 630 TS receiver, Fig. 5, also develops a negatively polarized signal across the output resistor, R_{137}. However, this output is capacitively coupled to the grid of the first video amplifier which receives its negative d-c component of bias from an external source. The lost

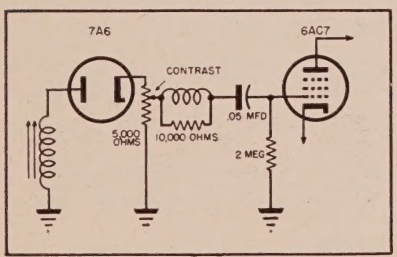

Fig. 6. Viewtone VP101A video detector.

d-c component of signal, when the signal is coupled through the capacitor, must be reinserted at a later point by a d-c restorer. The output circuit of the RCA detector consists of a band-pass filter consisting of C_{137}, L_{187} and the input capacity of the following stage, plus a shunt-peaking coil, L_{188}. The input circuit of the diode detector consists of variable inductor, L_{185},

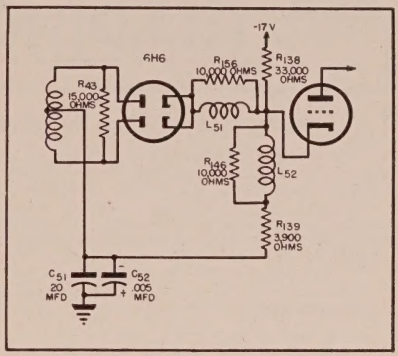

Fig. 7. RCA TRK-12 pushpull video-detector system.

which is resonated with the input capacity of the diode to the proper i-f frequency. A resistor, R_{136}, shunts the series coil of the output circuit to load this coil and prevent transients.

The i-f signal is applied between plate and ground in the Viewtone VP-101A television receiver, Fig. 6. Consequently, a positively polarized signal appears across the 5,000-ohm diode load potentiometer. In this receiver the potentiometer represents the contrast control of the receiver and varies the amplitude of the picture signal applied to the grid of the video amplifier.

To develop a higher amplitude detected signal, a push-pull detector is used in the RCA TRK-12, Fig. 7. The i-f signal is applied in push-pull across the diode plates, one diode conducting on one alternation of the i-f signal and the second diode on the other. A positive polarity signal is developed across the diode resistor R_{139}, and direct coupled to the cathode of the following stage.

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FOR SALE — Hallicrafters S-38, used very little. Price, $35. Michael A. Hart, 87 Sherman Ave., Jersey City 7, N. J.

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FOR SALE — Precision model 830 multimeter, $13.50; RCA portable radio, $16; RCA automatic record changer, $13; also parts, books, and tools. Write for list. Will trade for 8 mm. projector in good condition. G. H. White, 449 Wellington Rd., Mineola, L. I., N. Y.

WANTED — CX-220 tube, used in some of the Radiola battery models. Will pay what you ask. David W. Johnson, 208 East Main St., Orange, Mass.

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FOR SALE — Webster-Chicago model 80 wire recorder with volume and recording level indicator, complete with microphone and 3 spools of wire. Price, $140. Nina Bodenham, Riceville, Iowa.

FOR SALE — E. C. 1 Echophone receiver, perfect, $22; table model 5 tube Air King, $9; Vol. 4 Gernsback Service Manual, $3.50; Supreme Radio Service Course, $2; battery portable radio, $15; ear phones with plug, $1; Philco phono oscillator, $15. A Livingstone, 12-01 Ellis Ave., Fair Lawn, N. J.

TRADE — 30 Watt amplifier, crystal or dynamic, 12" P.M. speakers with cable, Electric Megaphone, bass accordian, clarinet. Want 48 or 80 bass piano accordian, bass violin or what have you? John Arnold, P. O. Box 84, Bluffs, Ill.

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SELL OR SWAP — C.R.E.I. Course, sections 2 and 3 complete. Need RME VHF 152 or equivalent cash, or what have you? John W. Mumma, 527 Higuera St., San Luis Obispo, Calif.

FOR SALE — Miscellaneous odd parts, tubes, etc. Low prices and guaranteed. Ed Howell, General Delivery, Gastonia, N. C.

FOR SALE — Triplet 1621 tube tester, $35; 7 volumes RCA service notes, 1931 to 1938, $6; Clough-Brengle model 185 unimeter, $35, perfect condition, in carrying case. Geo. A. Winter, Spooner, Wis.

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TRADE — Nine tube superhet RCVR, X-tal filter, remote control terminals, BFO, super-regen det., speaker included. Trade for good movie camera or good automobile radio. H. Schutzman, 1665 Vyse Ave., New York 60, N. Y.

FOR SALE — Mercury 11, 35 mm. camera with flash attachment, carrying case, flash bulbs, 6 rolls film, all new condition, $75. Also sound adapter kit for all 16 mm. silent projectors, perfect, $15. Complete instructions with both. Joe F. Cole, Box 353, Searcy, Ark.

FOR SALE — Dumont 3" oscillograph, type 224-A, $200. Send money order. Richard L. Hutchison, 934 S. Euclid Way, Denver 9, Colo.

FOR SALE — Silver "vomax", $45; Supreme model 589 tube and battery tester, $35. In perfect condition. Richard Hutchison, 934 So. Euclid Way, Denver 9, Colo.

FOR SALE — Rider's Manuals, Vol. 10 and 11, also RCA Victor Service Notes, 1938 and 1939. Make offer. All inquiries answered. Roger Hoestenbach, P.O. Box 603, McCamey, Tex.

FOR SALE — Feiler signal tracer, battery operated, in A-1 condition. Price, $25, or will trade for signal generator in working condition. Need 1232 tube, will pay cash for it. Michael Roman, 208 Goundry St., North Tonawanda, N. Y.

WANTED — Urgentlyl To borrow or buy wiring diagram and data for U. S. Army PE-110-C power supply made by Hallicrafter. Antone L. Oliveira, 94 Potomska St., New Bedford, Mass.

FOR SALE — Complete stock hearing aid repair parts. Will sell at cost, $202.39. Buyer will receive supplier connections and every possible aid in getting started. All inquiries answered. W. A. Mathewson, 208 Spruce St., Canonsburg, Pa.

WANTED — SX-25 in good condition, with or without speaker. Have S-38 in perfect condition, used 5 months to sell or trade for what have you. All letters answered promptly. William H. Bauer, Ward 4, U. S. V. A. Hospital, Outwood, Kentucky.

WANTED — Information for converting BC-223A transmitter to A.C. Will pay cash or trade radio parts. All inquiries answered. E. Shafer, 2889 East 116 St., Cleveland, Ohio.

ATTENTION — My mailing list covering the United States can help you get your radio items into the limelight. Have individual cities list and complete addressograph and mailing facilities. Let me know your individual problems. G. Samkofsky, 527 Bedford Ave., Brooklyn 11, N. Y.

FOR SALE — 22 lbs. of clean mercury at $2.25 per lb. Used in photographic process for sensitizing. T. F. Quarnstrom, 131 E. 5th Ave., Gary, Ind.

FOR SALE — Hallicrafters 15 tube receiver, SX-28, including matching Hallicrafters Jensen bass-reflex cabinet with 12" speaker. Excellent electrical and mechanical condition. Price, $195. Otto Pollei, Jr., 2122 Edgeland Ave., Louisville 4, Kentucky.

WANTED — Information on alignment procedure for Army surplus BC-344D receiver. Schematic for same. R. Daneker, 316 E. 2nd St., Lansdale, Pa.

WANTED — Roll film adapter, size 120 or 620 to fit 6 x 9 cm. film pack camera. Also 1947 tube checker in good condition. State price and condition. Arnold L. Halpern, 34 Second Ave., Long Branch, N. J.

FOR SALE — 90" auto antennas, 36" shielded lead, $2.75 each, postpaid anywhere in the U. S. Special price in lots of three, $8. Blue Radio, 368 Front St., Hartford, Conn.

FOR SALE — Hi-voltage R.F. power supply, 9000 volts; television set built at school work shop, cheap; R.O.P. tube and set tester, model 802N. Radio & Television Repair, 886 Fulton St., Brooklyn, N. Y.

FOR SALE — Meissner 3 tube regenerative receiver, 550 Kc. to 15 Mc., complete with tubes. Excellent condition. Price, $8.50. Otto Pollei, Jr., 2122 Edgeland Ave., Louisville, Ky.

FOR SALE — Rider Chanalyst, model 162E. Like new, $125. I. E. Hardy, Jr., 112 E. Washington St., Momence, Ill.

FOR SALE — Complete plans on several easy to build subminiature radio transmitters and receivers. All necessary parts now on market. Price, $1. Herbert W. Hall, Box 3145, Seattle, Wash.

SELL OR SWAP — Pair of Western Electric projector drive motors, 1/5 H.P., control cabinets complete with tubes, all in perfect condition. Cash or swap. Ray Ridgewell, Park Theatre, Rockland, Me.

FOR SALE — Precision EV-10 VT-VM in portable hardwood case, complete with UHF probe, original carton. Price, $82.50. R. A. Dressler, 355 Front St., Millersburg, Pa.

FOR SALE — Professional recording equipment, two complete Red-o-kut 16" turntables and overhead drives, recording amplifier in portable cases, microphones, stands, cables, needles, etc. $1,375 or best offer. Red-Ed Radio Clinic, 1937 First Ave., New York 29, N. Y.

FOR SALE — Hallicrafters S-40 receiver and SP-44 Panoramic, both perfect. Price, $120 with extra 8" speaker, $115 without speaker. Reply to all inquiries. R. J. Cartwright, 69 Mountfort St., Boston, Mass.

TRADE — Cardwell Condensers. Write for list. Would like to trade for anything useful in radio servicing. W9KHF, 912 W. 151st St., East Chicago, Ind.

SELL OR TRADE — PE-103-A dynamotor, $7; Silver Marshall short wave converter; electric megaphone unit complete; Superior tube checker, model 1240. All for $75, or will sell separate, or what have you to trade for above? Also have a battery eliminator. John Arnold, P.O. Box 84, Bluffs, Ill.

WANTED — Ten meter converter for mobile use. Prefer Gon-Set. Need filing cabinet also. Have Hallicrafters SX-28 and S20-R receivers and National NTX-30 transmitter and Motorola FMAR13V fixed mobile receiver for sale. E. F. Harris, 6748 N. Ashland Ave., Chicago 26, Ill.

FOR SALE — Grey finish rack model with power supply and 1.7-30 Mc. coils perfect condition. Price, $195 or best offer. Dick Wheaton, 220 Main St., Hobart, Ind.

FOR SALE — Tube and set tester, model 600, $55; signal generator, model A200, $40; signal tracer, model CA11, $14. All like new. Robert D. Chesney, R.F.D. 2, Box 740, Shamokin 2, Pa.

FOR SALE — Farnsworth 3 way portable radio, 6 tubes, excellent condition, $20; Emerson 3 way portable radio, 6 tubes, perfect condition, $21. V. Kozma, 3104 Wilkinson Ave., New York 61, N. Y.

WANTED — Volumes 3, 4, 5 of Riders Manuals. State price and condition. Joseph R. Pagacz, 813 Maxine St., Flint 3, Mich.

SALE OR TRADE — Janette converter, A-1, noiseless. Price, $32, or trade for portable. R. L. Patterson, 104 Carlton Ave., Brooklyn 1, N. Y.

WANTED — Urgently required 1943 Meissner Signal Shifter (ACN Dial on panel) with 80-40-20-10 meter coils. Burt Engel, 126 Webster St., N. W., Washington 11, D. C.

FOR SALE — Volumes 1-4, 6 and 11-13 of Riders Manuals. All in perfect condition. All for $50. Will ship immediately. G. A. Buseck, 101½ Sixth Ave., Gloversville, N. Y.

FOR SALE — Hickok Universal crystal controlled signal generator, model 288X. Extremely accurate, like new. Complete with leads and operating instructions. Also Simpson model 260 milliamp volt-ohmeter. Like new, with leads and directions. Both for $160, or what have you? Steve Krawetz, R.F.D. 1, Box 219, Derry, Pa.

FOR SALE — B.O.P. 7 tube auto receiver, complete with universal dash mounting assembly; Melrose 8 tube Neutrodyne home receiver, cabinet; Atwater Kent 6 tube home radio. All playing and in perfect condition. Roger Hoestenbach, P.O. Box 603, McCamey, Tex.

FOR SALE — Vomax vacuum tube voltmeter, very slight use, $50; Test-Rite model B-45 signal generator, excellent condition, $20. J. N. Cole, AGF Board No. 2, Fort Knox, Ky.

SELL OR TRADE — Weston model 771 tube checker, also checks volts and ohms. Price, $25 or a good used signal generator, or what have you? Neal Caiazza, Box 2152, Daytona Beach, Fla.

FOR SALE — BC348Q receiver converted for 110 volts a.c., perfect. Price, $75, or will trade for good 5" scope. Theo. Lyons, 3803 West 64th St., Chicago, Ill.

WANTED — Hallicrafters model S-21 Skyrider 5-10 receiver. State price and condition. A. W. Rennie, 41 Florida St., Buffalo 8, N. Y.

FOR SALE — 12 relays, DPDT Leach type 1127-FR. Designed to operate on 105-125 volts a.c., 60 cycles, 500 ohm coil. Used but in excellent condition, $1.25 each postpaid. Wm. Blanchard, 356 Grand St., Newburg, N. Y.

WANTED — Oscilloscope of a reliable make. Need not be in working condition. Also texts on mathematics for Radio Men. Clifford D'Lessig, 30 Fifth St., Frenchtown, N. J.

WANTED — Wiring diagram, or photostatic copy, and parts specification of Radar receiver — indicator R-65/APN-9, part of set AN/APN-9. A. Edward Ruppel, 1207 Adams St., Saginaw 54, Mich.

FOR SALE — General Electric 530 portable storage battery and A.C. operated, excellent condition. Price, $35, check or money order. M. Goldberg, 3336 Hull Ave., Bronx 67, N. Y.

SELL OR TRADE — Quantity sun lamp carbons, 40 cents doz; Westinghouse R-5 radio, fine playing condition, $8; Orpheum tenor banjo, $20, or trade in radio electric parts. Raymond Pregenzer, 225 West 23rd St., New York 11, N. Y.

FOR SALE — Radio & Electrical tools and books, including 16 Sams Photo-Folios, Zenith manual complete, set of Philco year books, G.E. manuals, etc. Write for complete list. F. A. Rand, Box 232, Winthrop, Me.

FOR SALE — P.B. 200 Superior V.O.M.A. and condenser checker, only used a few times. Price, $25. R. W. Gorseline, 6 Ocean Green, S.W., Washington 20, D. C.

SALE OR TRADE — 3A Kodak special 3¼ x 5½ f. 6.3 range finder, $50 or trade for Kodak 35 f. 3.5 R.F. George Feser, 92 Sewis Ave., Brooklyn 6, N. Y.

FOR SALE — Precision tube tester, model 912, needs new tube chart. Price, $25. Jac H. Huybers, Jac Radio & Refrigeration Service, Port Townsend, Wash.

FOR SALE — McMurdo silver "Vomax" model 900, guaranteed like new. Will ship express C.O.D. on receipt of $47.50 money order. Consider trade for good communications receivers. G. D. Cantrell, Veteran's Hospital, Legion, Tex.

FOR SALE — All standard makes of used radios in working order. Also many other items. Write for bulletin. Louis A. Goldstone, 1279 Sheridan Ave., Bronx 56, N. Y.

FOR SALE — Radio City Products vacuum tube volt meter, model 664. Like new, $30. Ray Brown, 44 Arden St., New York 34, N. Y.

FOR SALE — RCA voltohmyst Electronic voltmeter. Very little used, like new. Price, $65. Roy S. Blair, 928 A. Lincoln St., Watsonville, Calif.

FOR SALE — E.L. 307 Inverter, 6 D.C.-115 A.C., 100 watts. Want rifle, standard make shot gun (not less than 16 ga.), or 1 H.P. engine in good shape. Each to pay transportation charges. J. C. Richard, Bennetts Point, S. C.

FOR SALE — 20 tube FM-AM-SW Lafayette Concerto. Two amplifier inputs, two chassis, two speakers, all tubes, excellent condition. $150 F.O.B. N. Forcier, 293 Jefferson Ave., Salem, Mass.

FOR SALE — Triplett signal generator, model 625, vibroplex speed key (Bug), carbon "mike", Hallicrafters S-41-G receiver. Price, $95 plus postage. Geo. S. Stout, 1010 Chestnut St., Kansas City 1, Mo.

FOR SALE — Postwar Hallicrafter S-20R receiver, Argus, model C-3, 35 mm. camera, complete with all accessories. Both items in A-1 condition. Also photographic darkroom scale, Haynes Photometer and Skan exposure meter complete with case. Jim Madison, 310 Kellog Ave., Peoria 5, Ill.

TRADE — Kenyon T476 250 w. modulation transformer for anything useful in radio servicing. The Radio Laboratory, 912 West 151st St., East Chicago, Ind.

FOR SALE — Riders Manuals, Vol. 7-14, less Vol. 10, good condition; Photo Facts, Sets 1-17, at 20% off; also other service equipment. Wayne Connell, c/o Station KOKX, Keokuk, Iowa.

SELL OR TRADE — Antique stagecoach electric clock, excellent condition. Want electric drill with 1/2 or 1/4" chuck, in good condition. Milton Maultasch, 535 Grand St., Brooklyn 11, N. Y.

SALE OR TRADE — General Industries phono changer and recorder, No. BR-29-A; Hickok AC51 tube tester; Gernsback Manuals, Vol. 1-7. I want Hickok 277X or 288S. C. F. Carrick, 2004 Sherman Ave., Coeur D'Alene, Idaho.

WANTED — Dynamic tube tester and small multimeter with A.C. ranges. All letters will be acknowledged. B. Berman, 88 Stagg Walk, Brooklyn 6, N. Y.

TRADE — Perfect R.M.E. 43 communication receiver for a good television set or kit. Joseph J. Buckley, Arrot Arms-Apt. D12A, Arrot & Leiper Sts., Philadelphia 24, Pa.

MAIL AUCTION SALE — Set your own price on electronic equipment, sound powered telephones, instruments, amplifiers, tubes, etc. Write for descriptive list and bid sheet. Gifts 'n' Gadgets, 518A Hilton Ave., Catonsville 28, Md.

SALE OR TRADE — 169 American and Foreign stamps for collectors, some mounted on cards. Would like radio equipment and parts, or what have you? J. S. Lowe, 4509 White Ave., Baltimore 6, Md.

POSITION WANTED — Coyne Graduate Radio & Electrical, have 9 months experience in radio repair, excellent mechanical ability. John Kurpas, Jr., 46 Hickory St., Ellsworth, Pa.

SALE OR TRADE — Octal wafer sockets, blank 16" recording discs, glass base. Make offer. 6 V. vibrator supply, 210 V. output, $3.75. Portable 5-tube receiver, A.C.-D.C. battery, complete with tubes, less batteries, $24. Prices are F.O.B. Chicago. Paul H. Prokes, 9216 S. Menard Ave., Oak Lawn, Ill.

FOR SALE — Detrola 550C record changer, like new, complete with metal base. Price, $16.50. Triplett combination tube-set tester, like new. Write for particulars. C. Horn, 325 E. 163 St., New York 56, N. Y.

WANTED — Combination recorder-record changer unit in excellent condition. Earl W. Horne, Box 635, Jennings, La.

FOR SALE — Hallicrafters model SX-28-A receiver A-1 condition. Price, $165. Instruction manual included. Thomas F. Slack, 517 E. Wildey St., Philadelphia 25, Pa.

FOR SALE — Tubes, 45% off list, 25B8's at list; Universal crystal cartridge replacement for L-70, and others; 5-tube Superhets, $12.50. All parts and tubes guaranteed. Postage prepaid. Coin Radio Service, 68 Vine St., Hartford 5, Conn.

SELL OR TRADE — R.C.A. Radiola, Philco A.C.-D.C., Atwater Kent, Motorola (auto), Philco A.C.; Savil D.C.. Stancors P-6004, 6006, 6002, 6868. Want good working television or kit; Riders Manuals 1-5 (not abridged), up to 16. No reasonable offer refused. Adam M. Graham, 82 Marion St., Brooklyn 33, N. Y.

FOR SALE — Bliley VF-1 40 and 80 meter variable frequency crystals. Slightly used, guaranteed. Price, $3.50 each. Send card for frequencies. Ralph W. Kirchberger, R.D. 1, Union, N. J.

FOR SALE — Unused lightweight Heyward Air Compressor, suitable for paint spraying outfit. Price, $10 F.O.B. Robert Garbarini, 42-12 68 St., Woodside, N. Y.

WANTED — Second I-F transformer for Majestic Radio, model 25. It has 5 leads on it, including center tap. Also want R.C.A. Victor amplifier, RE-45. J. Vander Adams, 102 4th St., Hot Springs, Ark.

FOR SALE — Complete stock of service equipment, parts and tools. CA 11 tracer, $14; Monitor SG101 Crystaliner signal generator, $50; RCP 802N combination tube and set tester, $47.50. Write for complete list. Andy's Radio, Box 914, Maud, Okla.

WANTED — Clough-Brengle 2" oscilloscope or similar in any condition. Write stating condition and price. B. B. Bryant, Castle Point, N. Y.

FOR SALE — Tubes and parts from recently closed radio service shop. Dealer's net cost for entire stock, $275. Sell as one unit or in lots. Send for list. High-Tor Radio Center, Haverstraw, N. Y.

FOR SALE — 300 amplifiers 3-tube, $3 ea. or $30 per doz.; manufacturers type 50-L-6 tubes, 50 cents ea., $5.50 per doz. Need Riders Manuals 9, 12, 13; will trade amplifiers or pay cash. Also for sale, Sylvania portable tube tester, $65. University Radio Service, 25 Parker Ave., Buffalo 14, N. Y.

FOR SALE — Riders Manuals Vol. 1-3, 10, 13-15; 1941 Radio Circuit Manual; automatic record changer and recorder manual; Trouble Shooters Handbook. All manuals are in good condition. All for $65. R. Ralph Lucas, 7915 Jeffries Ave., Cleveland 5, Ohio.

SELL OR TRADE — 1947 N.R.I. Radio and Television Course, like new, $35; ATR inverted, input 6-12 V., output 110 V. A.C., 60 cycle, 125 W., $18; box of radio parts, $8; N.R.I. power pack, $20. Trade for good tube tester, late model. Travis Heard, 893 Waddell St., Athens, Ga.

WANTED — Radio cabinet for Philco model 41-246 or back date Electrical Appliance Service magazines. Have for sale or trade set of Coyne 3 Vol. electricity reference books, some parts, tubes, etc. Luther F. Asebes, Box 296, Omar, W. Va.

SELL OR TRADE — Instructors' copies of DeForests Training Courses, 169 lessons, 9 leather binders. Make offer, or will trade for good 16 mm. projector or movie camera. Stanley J. Radwanski, 1824 Washington Ave., Vincennes, Ind.

SELL OR TRADE — Solar 2¼ x 3¼ photo enlarger. Want mutual conductance tube tester, preferably counter type, Dumont 208B, or Hewlett-Packard 400 VT-VM. L. M. Lang, 70 Hyland Ave., E. Greenwich, R. I.

WANTED — Type FT-253-A mounting for BC-653-A, CT sealed 250 or 300 ma plate transformer, two sealed 250 or 300 ma filter chokes, two 1613 tubes. Cash or trade my surplus. Malcolm E. Hughes, 4819 Euphrosine St., New Orleans 15, La.

FOR SALE — Radio tubes, 50% off current list price. All types available in sealed cartons, standard makes only. Any quantity, 25% with order, balance C.O.D., Severn, 732 Carroll St., Baltimore 30, Md.

FOR SALE — Transvision 7" television set completely wired, F.M. sound and synchronized circuits, cathode ray tube in sealed carton. Price, $210. Emanuel Bloom, 1153 Fifty-third St., Brooklyn 19, N. Y.

FOR SALE — Complete shop as unit; Hickok 19X crystal controlled signal generator, $95; Riders Abridged 1-5 and 6-14, $135; BC 348-H and speaker, $65; BC375-E less tubes, $10. Send for list. Cecil R. Nelin, 1203 N. Walnut, Brady, Tex.

FOR SALE — Riders Manuals, Vols. 1-4, $20; Vols. 6-8, $30; Vols. 3, 4, 7, $20; Vol. 15, perfect, $15. C. T. Fisher, 1385 H St., N. E., Washington 2, D. C.

WANTED — One 12B8GT and one 25B8GT tube. State condition and price. Robert D. Sperling, Asbury Park Vet. Apts., Apt. 1, Belmar, N. J.

FOR SALE — Model 900 "Vomax", $45; model 136 signal generator, $30; Wollensak enlarging lens F3. 5-3", $22; Webster automatic recorder, changer plays 17 mixed records, $60. All items perfect. J. Bourke, 35 East Rockaway, New York, N. Y.

FOR SALE — Thordorson 250-500 ohm line to P.P. Grids, T61A94; Jefferson 250-500 ohm line to P.P. Grids, 467-178. These are both like new; $3 for the pair. Erwin F. Poland, Box 217, North Lewisburg, Ohio.

WANTED — Several hundred W. E. delay networks No. D 163169. State price and quantity available. P. Astra, Moore School of Electrical Engineers, University of Pennsylvania, Philadelphia 4, Pa.

FOR SALE — Approved model A-100 signal generator, like new, $40; Superior 400 multitester, $45; Universal tube tester, portable, $35. All for $110.00. Radio Clinic, Box 151, Bottineau, N. Dak.

FOR SALE — BC-1068A receiver, partly converted; inter-com. 2 station; public address system; Johnson NX-125 neutralizing condenser; Electrovoice 605 dynamic mike; neon transformer; Post slide rule. Eugene Wille, 3435 N. 47th St., Milwaukee 10, Wis.

FOR SALE — Pair of RCA 813, $10 pair; pair Eimac 304TL, $3.50 ea.; pair of 100th at $12 pair; FB7XA receiver with 40M coils, $15. Need four 230A; also German 35 mm. camera. C. Boryseivich, 1066 President St., Brooklyn 25, N. Y.

FOR SALE — Ghirardi's Radio Physics, second edition. Price, $3. Ray Goldstein, 419 B 11th Lane, Brooklyn 12, N. Y.

FOR SALE — Electronics signal generator, model A-200; Silver Vomax volt-ohm milliameter, model 900; Radio City tube tester, model 315, like new. Make offer. All inquiries answered. Everett Dunton, Main St., City Mill, Mass.

FOR SALE — Two McMurdo Silver Atom X75 watt transmitters, complete set coils 3.5 mc. through 54 mc., and tubes, $35 each. Two power supplies, complete, for above, $15 each. H. L. Moershfelder, 140 High Park Blvd., Buffalo 21, N. Y.

WANTED — Riders Manuals Volumes 1 through 11. Oscar W. Faulk, Midland, N. C.

TRADE — Xmitting tubes 2-811, 2-812, 6-807, 2-866, 1-FP265, 300 watt TR10DE. Will trade for anything useful in radio servicing. The Radio Laboratory, 912 West 151st St., East Chicago, Ind.

WANTED — Position as assistant radio repairman. Have gone to school for same and did same work in Army. Louis J. Amarosa, Jr., 22-60 27th St., Long Island City 5, N. Y.

FOR SALE — Blilev crystals, one type LD-2 and one type B-5, $1.50 each, both for $2.50. G.E. UHF thermocouple ammeter, 0-4 amp., $3. My swap for yours. Raymond H. Ives, 822 Windsor Ave., Norfolk 4, Va.

FOR SALE — 4 6H6 tubes, 18 6SN7 tubes, 4 6SJ7 tubes, 4 6V6 tubes, all still in original cartons. All for $35. James Spiro, 111 Pine St., Rockville Centre, N. Y.

FOR SALE — Mark II Tank Transciever, complete. Price, $40. Shipped prepaid. All inquiries answered. C. J. Diodati, 2363 Margaret St., Philadelphia 37, Pa.

WANTED — To buy or rent Drawing of Approved Technical Apparatus tube checker, model 1300-A-B-C, and testing information. Jewell Radio Service, Box 24, Irving, N. Y.

FOR SALE — Utah 6 volt power pack to test auto radios, perfect condition, $20; 150 Sylvania 6A4-LA tubes, bulk, 10 for $5, lot for $60; RCA 832 and 1630 tubes with sockets, $3 each, F.O.B. Harold Brown, 3817 West End Ave., Chicago 24, Ill.

FOR SALE — Choke, receiver, tubes, transmitters, power supplies, ant. tuning unit. Write for information. Al Svirmickas, 7202 So. Fairfield, Chicago 29, Ill.

FOR SALE — Meissner 3-tube regenerative receiver, 550 Kc. to 15 Mc., complete with tubes, $8.50. Otto Pollei, Jr., 2122 Edgeland Ave., Louisville, Ky.

FOR SALE — Radio supplies, electric clock, Popular Science magazines, surplus war goods, oilstove burners and parts. Write for list and information. Evan H. Griffiths, R. D. 1, Rock-Creek, Ohio.

FOR SALE — NC 101X National short wave receiver with noise limiter, $65; 1940 Hudson auto radio, $35; Motorola auto radio heads, 1939 and later, $5. Best Radio Shop, 3349 Fulton Road, Cleveland 9, Ohio.

WANTED — Answer sheets to National School (Los Angeles, Calif.) course, from lesson 38 to 120. Will pay $5 for the sheets. Hobert Kiser, Box 175, Ravenswood, W. Va.

SELL OR TRADE — 1947 model dynamic electric welder, very little use. Rods, helmet, cables and electrode holder included, $22.50. Or trade for late model signal tracer or what have you E. A. Vaughan, Pell City, Ala.

TRADE — Philco 6-tube auto superhet complete for signal generator, VTV, Instructograph code machine, or what have you? All inquiries answered. Frank Vedcal, 4378 W. 25th Place, Chicago 23, Ill.

SELL OR SWAP — Coronada 4 tube battery pack radio; Kadette 110 volt A.C. radio, good condition; Supreme signal generator, model 576; Supreme tube and set tester, model 599-A. Seffker Electric, Box 404, Arnold, Neb.

WANTED — A used, low priced signal generator. George Nerenberg, Box 156, Jansen, Sask., Canada.

FOR SALE — Professional high fidelity recorder, new condition, complete. May be used as P. A. system. Price, $135. Emmett Anderson, 217 "E" St., S. W., Auburn, Wash.

WANTED — Position as radio service man or helper in radio shop in Philadelphia, Pa. Two years home experience repairing radios, plus radio school and home study. B. Joeckel, 2455 N. Hope St., Philadelphia, Pa.

WANTED — Small communications receiver such as Sky Buddy, in playing or in repairable condition. Describe and give price. William A. Conklin, 70 Community Drive, Cranston 5, R. I.

WANTED — 8 mm. movie editor complete with viewer, rewinds, and splicer; any of the above items singly; adjustable projector stand. State make, condition, and price. Also want 8 mm. movies or shorts. State names and price. L. Fielkoff, 143-48 41st Ave., Flushing, L. I., N. Y.

FOR SALE — 8 watt mike and phono amplifier; crystal microphone and hi quality desk stand; used radios and old type tubes; no. 26 and no. 36 magnet wire; Cardwell 15 mmf. variable condenser. Peter Bedrosian, 2 Unicorn St., Newburyport, Mass.

SELL OR TRADE — Superior model 1240 tube tester in good condition. Want Kodak 35 camera, with or without range finder. Will pay difference on camera, or sell tester outright. R. Oschmann, 1821 Nostrand Ave., Brooklyn 26, N. Y.

SELL OR SWAP — 98 issues of QST, 1938-1947, in A-1 condition. Best offer. Teleplex, like new, with 20 lessons and instructions, $20. Stancor DC-3 radiophone transmitter, $8. Other items, my list for yours. Raymond H. Ives, 822 Windsor Ave., Norfolk 4, Va.

SELL OR TRADE — Weston model 777 tube checker, like new. Want Precision E-200 signal generator in good condition, with instruction book, or $45. Tuxedo Radio & Electrical Co., 3044 Ocean Parkway, Brooklyn 24, N. Y.

FOR SALE — K & E Mercury Drawing Set N9125½, 13 pieces, including 3 bow compasses, in original box. Also K & E N 4058 slide rule. Both, $16. S. Feldman, 45 Lott Ave., Brooklyn 12, N. Y.

TRADE — Hammarlund Comet short wave receiver; A.C. TRF 5 tube short wave receiver. Am interested in a popular, good quality 35 mm. camera. Milton Wendroff, 1745 East 16 St., Brooklyn 29, N. Y.

FOR SALE — Cable connectors 3, 4 and 8 conductor, at 20 cents per set. Add postage or will ship express collect. G. D. George Co., 625 S. Goodman St., Rochester 7, N. Y.

WANTED — 1238 radio tube, new or used; also instructions on how to operate signal generator, model SG43, A.C., 60 cycles. Rex Cards & Radio, 6404 11th Ave., Brooklyn 19, N. Y.

FOR SALE — 1936 Ford (Philco FT9) receiver, $25 C.O.D. Perfect condition. Grant LaMaye, 548 E. 6th St., Erie, Pa.

FOR SALE — 2 auto radios; 6 tube superhet; 15 watt amplifier, less tubes and speaker, all for $40. Signal Tracer complete with tubes, $20. Edmon Smith, R. 1, Buechel, Ky.

FOR SALE AND WANTED — 200 microamp meter for sale. Price, $3. Want a burned out Weston model 301 meter or case. Jack Nelson, 75 Minaville St., Amsterdam, N. Y.

WANTED — Gasoline driven portable motor generator, 110 V., 60 cycle, 500 to 1000 watt output. Advise cost and condition. M. T. Shamonsky, 1125 Meade Ave., Scranton 8, Pa.

WANTED — French language course on records. Must be complete with all accompanying printed material. State price. Charles Cote, 111 Woodlawn Circle, East Hartford, Conn.

FOR SALE — Model JFM-90 G.E. F-M tuner, 42-50 Mc., chassis and dial indicator, A.C. power supply. Price, $20. N. Wernick, 1723 Woodbine St., Ridgewood 27, N. Y.

SELL OR TRADE — BC-375-E radio transmitter; Sun-Kraft ultra violet lamp; Univex 3.5 lens; Acme 35 mm. motion picture projector, other photo equipment; radio and electrical equipment. Want test equipment, radio, electrical, and chemical books, telescope. Hansen Radio Service, 165 Silverbrook, Niles, Mich.

WANTED — Old issues of Modern Electronics, Popular Electricity, QST, 1919 and 1920. Cash, or will swap for other old issues. J. Lipani, 157A Leverett St., Boston 14, Mass.

WANTED — Used 3" or 5" oscilloscope. Will pay cash, or trade radio parts. State model, condition, and price or needs. Alco Electronic Lab., Box 214, Lawrence, Mass.

WANTED — Radio Craft and Radio Maintenance Magazines, 1934-1945. Will pay 5 cents each and postage. Must be complete, covers unnecessary. Send dates first. Morris E. Jacobs, 371 East 179th St., Bronx 57, N. Y.

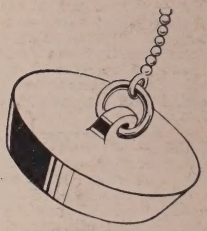
WANTED — 6B5 tube. State price. Will swap 3 of any of the following tubes: 6SJ7, 6SK7, 6SN7. Robert Kichline, 428 Filbert St., Easton, Pa.

SELL OR SWAP — Complete surf radio equipment, German silver surf reels, free spool and drag. Have three for electronic V.T.V.M. Riders 7-10. Fred M. Merrill, Box 92, Callicoon, N. Y.

FOR SALE — Radio City model 663A electronic multitester, with test prods and operating instructions. Price, $40. George Wilson, 1260 Bushwick Ave., Brooklyn 7, N. Y.

WANTED — 8 and 16 mm. films of all kinds; reels, cans, and cases. Spot cash or swap basis. Books and courses to swap. What have you? Frank H. Snyder, 2412 11th Ave., Watervliet, N. Y.

a "plug"



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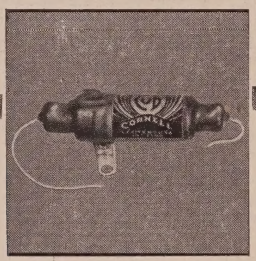

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